Monitoring Study Group Meeting Minutes

July 24, 2007
CAL FIRE Shasta-Trinity Unit Headquarters, Redding

The following people attended the MSG meeting: George Gentry (BOF—chair), Jim Ostrowski (BOF), Tharon O'Dell (GDRCO), Kevin Faucher (CTM), Dr. Tom Lisle (USFS-PSW), Dr. Michael Wopat (CGS), Richard Gienger (HWC/SSRC), Dr. Cajun James (SPI), Jack Lewis (USFS-PSW), John Munn (CAL FIRE), Mike Gaedeke (OSU/Cal Poly SLO), Mike Liquori (Sound Watershed Consulting), Bob Carey (W.M. Beaty & Assoc.), Angela Wilson (CVRWQCB), Joe Croteau (DFG), Clay Brandow (CAL FIRE), Dr. Sari Sommarstrom (Sommarstrom and Assoc.), Dr. Richard Harris (UCB), Stewart Farber (Timber Products Co.), Anthony Lukacic (CAL FIRE), Stormer Feiler (NCRWQCB), and Pete Cafferata (CAL FIRE). **[Note: action items are shown in bold print]**.

We began the meeting with general monitoring-related announcements:

- Pete Cafferata announced that the California Forest Soils Council (CFSC) is holding their 2007 Summer Field Tour on September 7-8th. Friday will be spent at Blodgett Forest near Georgetown and Saturday will be on the Eldorado and Tahoe National Forests. Contact Jeff TenPas, CFSC Chair, at 707-562-8955 for more information.
- Pete Cafferata stated that the Northern California Society of American Foresters (SAF) Summer Meeting, titled "Landscape Forestry Research in the 21st Century," will be held on August 10-11th at the Institute of Forest Genetics in Placerville. Contact is Mike DeLasaux, UCCE, 530-283-6125, mjdelasaux@ucdavis.edu.
- Richard Gienger announced that the 10th Annual Coho Confab will be held on August 17-19th in Petrolia. The event is co-sponsored by the Trees Foundation, Salmonid Restoration Federation, Mattole Restoration Council, Mattole Salmon Group, and the Sanctuary Forest. For more information, see either of the following websites: http://www.calsalmon.org/ or http://www.treesfoundation.org/.
- Richard Harris stated that he is organizing a workshop titled "Designing, Improving and Maintaining Rural Low Standard Roads in Calaveras County" on October 11th. Richard also announced that several UC Cooperative Extension (UCCE) small landowner forest stewardship workshops will held Sonoma County and in southern California later this year. The contact is Sherry Cooper, UCCE, 530-224-4902, email: slcooper@nature.berkeley.edu.
- Pete Cafferata stated that workshops titled "Culvert and Road Drainage Practices to Protect and Benefit Steelhead and Water Quality in the Central Coast Region" (aka Roads and Culverts Field School) will be held on August 14-16th in San Luis Obispo County (Arroyo Grande) and on October 23-25th in Santa Barbara County. Course instructors are Dr. Bill Weaver and Danny Hagans of PWA. The workshops are sponsored by the Salmonid Restoration Federation and the California Department of Fish and Game Coastal Salmon Recovery Program. The contact is Stephanie Wald, 805-473-8221. see: http://www.pacificwatershed.com/pacific-watershed/news/news-item-3.html
- Clay Brandow announced that The Council of Western State Foresters has released a new report titled "Forest Best Management Practices (BMPs) for Western States: A Summary of Approaches to Water Quality Implementation and Effectiveness Monitoring" (see: www.wflccenter.org/news_pdf/240_pdf.pdf). The report summarizes how nine of the western states, including California, have monitored the implementation and effectiveness of BMPs on private and state forest lands to protect water quality.
- Angela Wilson informed the group that the BOF's Road Rules Committee is making a few last minute changes to their proposed rule package, which they plan to present to the BOF at their August meeting. Changes are needed due to language included in the recently approved Road Management Plan and Coho Salmon Incidental Take Assistance rule packages.

Comparison of Turbidity Data Collected with Different Instruments

Mr. Jack Lewis, USFS-PSW Mathematical Statistician, provided the MSG with a PowerPoint presentation on the final report he wrote with Rand Eads and Randy Klein titled "Comparisons of Turbidity Data Collected with Different Instruments." The project was partially funded by CAL FIRE and the final report is posted on the Monitoring Study Group website at: http://www.bof.fire.ca.gov/PDFS/Tprobe_final_report.pdf. **A shorter paper will be submitted to a peer reviewed journal for publication soon.**

Jack began his presentation by defining turbidity as cloudiness measured by the attenuation of scattered light. Turbidimeters measure turbidity by shining a light into the suspension and measuring the attenuated or scattered light. Different instruments have the light source and light detector devices set at different angles, so it is not surprising that different sensors produce dissimilar turbidity measurements. Specific turbidity standards or methods that have been set include: ISO 7027 (infrared light source, detection angle 90^{o}), EPA Method 180.1 [for drinking water] (white light source, detection angle 60-120^{o}), and backscatter [OBS] (usually infrared light source, detection angle 180^{o}). In general, turbidimeter readings do not agree because: (1) they may conform to different standard or non-standard methods, and (2) within a defined method, designs vary (e.g., shape of light beam and detector cone, scattering angles detected, daylight filters, lenses, windows, and circuitry). Clearly, there is a need for standardizing turbidimeters, since monitoring studies continue to use a variety of devices, and it would be desirable to combine or compare data from different studies. Methods to standardize turbidimeters include: (1) refining the definitions of standard methods so that the sensors agree better, and (2) determining relationships between sensors so that values from one sensor can be converted to equivalent values from another instrument. The latter approach requires that relationships be independent of the type of sediment being measured and was the major thrust of this study.

The main objectives of the project were to quantify the differences among several turbidimeters and to determine the magnitude of errors associated with attempts to standardize data. Eight instruments were used in the study, six in situ devices (OBS-3, OBS-3+, DTS-12, NEP395, YSI 6026, YSI 6136) and two portable/bench top units (Hach 2100P, Hach 2100AN). Upper limits for turbidity measurement with these instruments varied considerably. Sediment samples were obtained from 10 watersheds located in the northern part of California's Coast Ranges. These watersheds all have soils derived predominantly from sedimentary rocks, including the Franciscan Formation and other marine or continental sedimentary deposits. Sources sampled included streamside landslide toe material, streambanks, road inboard ditches, and fine in-channel alluvial deposits, with a wide variety of particle size distributions. Altogether, there were 24 different sediment types that were mixed to 7 different concentrations to reach targets of 25, 50, 100, 200, 400, 800, and 1200 turbidity units. A mixing apparatus was devised for suspending the sediments during measurement by the in situ sensors. The device consisted of a stand for suspending a turbidity sensor and a variable-speed electric drill fitted with a paint-mixing paddle in a 12-quart bucket. Three readings were recorded with a Campbell data logger for each instrument and sediment mixture combination.

The results indicate that readings of the same sediment mixture by different sensors commonly differed by up to a factor of two and, in the most extreme case, by a factor of three, depending on the specific meters and the sediment. Conversions of data from one meter to equivalent values from another were sensitive to the type of sediment being measured and were often curvilinear. Relationships between sensors often tended to diverge

as turbidity increased. Somewhat less dependency on sediment type was observed between sensors that conformed to the same measurement standard (i.e., backscatter, EPA Method 180.1, or ISO 7027). Relationships between meters that use infrared light and meters that use white tungsten light were the most variable. In other words, conversions between meters of similar design were found to be less prone to error than conversions between meters of contrasting design. Jack reported that YSI sensors were found to comply with ISO standards, but they only measure turbidity values up to 1000 FNUs.

Several models were considered for evaluating the error associated with assuming a fixed relationship for converting turbidity readings among sensor types. Among parametric models evaluated, log-log regression most often gave the best fit, followed by quadratic regression. The form of the best relationship was found to depend on the particular sensor pairing. Average errors in converting between meters of similar design were almost always less than 15%. Since most field meters use infrared light, Jack stated that it may be wise to equip benchtop meters with infrared filters or lamps for better cross-site comparisons (when EPA methods are not required). He cautioned, however that while this may improve the measurement errors, it is unconfirmed at this time. The current study verifies findings from earlier work that turbidity measurement standards need to be made more specific.

Jack's main conclusions were that: (1) relationships between turbidity readings from different sensors are not fixed and depend on the sediments being measured; (2) turbidity rankings by different instruments are likely to be robust when turbidity differs by a factor of two or more; (3) relationships between sensors are, in general, less variable when the sensors are of similar design (standardization to lab meters that use tungsten lamps may introduce relatively large errors); (4) if equations in the final report are used with North Coast sediments, potential errors should be reported as given in the report, with consideration of the specific sediments being measured (results are probably conservative given the variety of materials used); and (5) these results should apply in a general sense outside the North Coast, but the magnitude of errors may be different.

During discussion following the formal presentation, Jack stated that, if possible, it is best to measure suspended sediment concentration along with turbidity, since it is a more repeatable parameter (e.g., Turbidity Threshold Sampling or TTS). He cautioned, however, that it is difficult to regulate land use practices with either of these water column measurements due to high levels of temporal variability. Cajun James stressed that this work shows that it is important to use the same type of turbidimeter for a study once initial data has been collected.

Caspar Creek Watershed Study—Planned Phase III Operations

Next, Dr. Tom Lisle, USFS-PSW Research Hydrologist, provided a PowerPoint presentation on the planned Phase III operations for the Caspar Creek watershed study. Tom began the talk by stating that before devising a strategy for the next phase of the Caspar Creek project, it became apparent that it was essential to determine what forest managers need to know regarding forest management impacts. To answer that question, the USFS-PSW watershed scientists in Arcata have been writing a Caspar Creek Context Analysis document. This work will provide information needed to properly design "Experiment 3" by: (1) identifying knowledge gaps from previous experiments, (2) examining the regional applicability of Caspar Creek results, (3) providing an evaluation of cumulative effects, and (4) identifying constraints and opportunities for experimental treatments in the South Fork Caspar Creek watershed.

Prior to delving into the Context Analysis work, Tom provided background information on the Caspar Creek watershed, where erosion, sediment, stream discharge, and aquatic/riparian ecosystems have been studied since 1962. This description included watershed size, geology, soils, precipitation, vegetation types, fish species, etc. He also briefly described the first phase of the project, when the South Fork was selectively tractor logged from 1971 to 1973, and the second phase, when approximately half of the North Fork was clearcut, mainly with cable yarding, from 1985 to 1991. Abundant information on the study, publications, real-time data, and photographs are available at the Caspar Creek website: http://www.fs.fed.us/psw/topics/water/caspar/.

The Context Analysis work is revealing what we do and do not fully understand in this coastal watershed. For example, Dr. Lisle stated that one of the key watershed processes that has been studied in the North Fork is interception loss. Approximately 21% of incoming precipitation in lost in uncut second-growth redwood/Douglas-fir stands when compared to input in clearcut units, and this has a significant effect on runoff. USFS-PSW staff are currently studying this process in the selectively harvested South Fork. Water yield and summer low flow discharges have been studied in the past in both the North and South Forks, with considerable differences observed between the basins due to remaining conifer stocking levels.

Sediment yield and peak flow recovery over time has been documented for both watersheds, with peak flows recovering in the North Fork in approximately 11 years. Nick Dewey's Masters Thesis work at HSU has shown that headward expanding gullying is a very important process and a significant source of sediment in both basins. In the North Fork, gully headcuts are spaced, on average, every 10 meters in first and second order tributaries. Their frequency and size are related to old-growth logging practices that took place in Caspar Creek from the 1860's to approximately 1905. In summary, changes in interception loss and gully headcutting appear to be very important processes in Caspar Creek affecting streamflow and sediment generation under wet mantle conditions.

Schematic maps of unit area sediment output in the North Fork before and after logging show that sediment yields have been increasing following logging in watershed "D" due to increased gully erosion. These maps also show increased sediment storage along the lower part of the main stem of the North Fork, which has resulted from added large wood that entered during a large wind storm in 1995, when buffer strip trees were blown down. The amount of in-channel sediment storage capacity has been found to be very important for sediment yields at the downstream North Fork weir. Sediment budget work for the North Fork has revealed that input of sediment from landslides and gullying exceeds current output values, with net alluvial storage. A strong "linkage" has been found between reduced canopy cover ⇨ decreased interception loss ⇨ increased subsurface flow ⇨ increased soil pipe and gully erosion ⇨ increased sediment generation.

Chapter 5 of the Context Analysis discusses the kinds of cumulative impacts of concern at different spatial scales, and describes knowledge gaps that are hindering impact analysis. The second Caspar Creek experiment was focused on quantifying cumulative impacts, but it restricted its view to the impacts of that experiment's logging (i.e., it was concerned with spatial accumulations of impact). An important gap in our ability to evaluate cumulative impacts is a framework for assessing temporal accumulations of impacts (i.e., past, current and future logging) and how they affect biological/physical processes. Information needs for managing cumulative impacts include documenting recovery rates, mitigation effectiveness, and multi-cycle process interactions.

Based on Caspar Creek Context Analysis work completed to date, priority research topics include: (1) comparing hydrologic responses from selection and clearcut logging, (2) assessing the effects of rehabilitation activities (impacts, recovery timing, effectiveness), and (3) evaluating multi-cycle logging interactions (including sediment, large wood, gullying). Experimental constraints in the South Fork, where the next phase of the experiment will take place, include management requirements next to adjacent state park and private ownership lands, marbled murrelet critical habitat requirements from USFWS, and a recent landslide in the UQL subwatershed. Potential treatment strategies include: multiple case studies, multiple replicates, treatment gradient, sequential treatments, and combination (sequential + gradient). Tom stated that he prefers the "treatment gradient" strategy (i.e., light selection, heavy selection, clearcut). Potential subwatershed treatments for the South Fork were discussed at the last Caspar Creek work plan meeting held in late May but they are still under development due to uncertainty regarding wildlife constraints.

Update on the Judd Creek Cooperative Instream Monitoring Project

Dr. Cajun James, SPI, provided the MSG with an update on the Judd Creek Cooperative Instream Monitoring Project located in Tehama County. She began by giving a brief history of watershed research in the basin. The BOF granted SPI experimental watershed status in 2001 for the Judd Creek watershed. Abundant baseline data for water temperature, riparian microclimate, flow, sediment, large wood, and macroinvertebrate composition are available along the lower three clearcut units that were studied as part of Cajun's Ph.D. work at UC Berkeley (i.e., Southern Exposure Research Project). This work included two stream water quality monitoring stations. The expanded Judd Creek Cooperative Study with CAL FIRE added three stream monitoring stations. These stations were constructed in 2004/2005 and Montana flumes were installed at all of the stations in November 2005. YSI Sondes are used to document turbidity, DO, water temperature, and conductivity. ISCO pump samplers provide water samples for suspended sediment concentrations. Abundant rainfall in water year 2006 produced peak discharges of up to 120 cfs, but limited precipitation in 2007 yielded peaks only to 30-40 cfs. Turbidity values have often been low, but spikes up to 980 NTUs have been recorded. Peak turbidities for a given storm event have varied considerably by station. Watershed treatments in the expanded study will utilize the approved Engebretsen THP, with 41 clearcut units (average size 20 acres). The total clearcut area is 816 acres, which is 13% of the Judd Creek watershed area. Extensive road improvement and abandonment is also proposed as part of this plan to reduce sediment generation. The road work is underway this summer and the clearcut units will be harvested in 2008 and 2009, with three years of post-logging data collection to occur. The draft study plan for the Judd Creek cooperative project is posted on the Monitoring Study Group webpage at: http://www.bof.fire.ca.gov/pdfs/Judd%20Creek%20Final_Prospectus_MSG_maps.pdf.

Dr. James also provided a brief summary of seven years (2000-2007) of water temperature data from the Southern Exposure Research Project. Treatments included: before 2000—untreated; Aug 2000—clearcut to 175' from the streambank; Oct 2001—clearcut to 100'; 2002—no treatment; Oct 2003—clearcut to 50'; Oct 2004—economic clearcut of remaining buffer strip; 2005--2007—no treatment. Riparian canopy cover was measured with a siting tube, Solar Pathfinder, spherical densiometer, and with hemispherical photography. Water travel time experiments have been conducted with dye tracing (30 min to 1.2 hr for 1250 to 1600 ft). Maximum daily water temperature changes of almost 2^{o} C were noted with canopy reductions from 90% down to 50%, as measured with the spherical densiometer and with summer discharges of 1.5 to 2 cfs. MWAT data showed a similar pattern to that produced for daily maximum temperatures.

MSG Monitoring and Tracking Subcommittee Update

George Gentry stated that he will setup the first MSG Monitoring and Tracking Subcommittee meeting in early August. He informed the group that he expects that the subcommittee meetings will be conducted by conference calls and that information/document sharing will be accomplished by email, thereby reducing time commitments by subcommittee members. Mr. Gentry listed the subcommittee members expected to participate as: Gentry (BOF), Cafferata and Munn (CAL FIRE), Gienger (HWC/SSRC), Harris (UCB), Wopat (CGS), Coe (CVRWQCB), Hope (NCRWQCB), Lee (SWRCB), Babcock (DFG), and Levesque (CTM). The subcommittee's tasks are to: (1) review and improve the draft list of monitoring activities that are occurring on private timberlands, (2) evaluate the effectiveness of each approach in providing information on impacts to the beneficial uses of water associated with timber harvesting operations—especially impacts to listed anadromous fish species, and (3) evaluate the costs and benefits of the various monitoring approaches to aid the BOF, timberland owners, regulatory agencies, and the public in selecting adequate, cost effective monitoring approaches that will help ensure the protection and recovery of listed species.

Brief FORPRIEM Update

Clay Brandow provided a brief update on the status of the second phase of the Modified Completion Report monitoring program, now called FORPRIEM (Forest Practice Rules Implementation and Effectiveness Monitoring). **Training sessions for CAL FIRE Forest Practice Inspectors are currently being scheduled for August-November. The final version of the revised methods manual is available on the MSG website at: http://www.bof.fire.ca.gov/PDFS/FORPRIEM_ProceduresandMethodsCompletePackage_BandW_07122007.pdf**

Brief Update on Interagency Mitigation Monitoring Program Subcommittee Work

Pete Cafferata informed the group that the MSG IMMP Subcommittee last met on May 8th in Willows to agree on a revised set of watercourse crossing field protocols for testing in the second phase of the IMMP pilot project. The Coast and Inland teams each spent four days in May and June using these protocols. Both teams agreed that the new protocols were better, but that additional refinement was needed. Angela Wilson stated that the Inland team met on July 17th and 23rd to make these changes. **Shane Cunningham, CAL FIRE, is revising the protocols and adding a water drafting section. This new version will be field tested on one plan by the Inland team and six plans by the Coast team this summer and fall. Following the completion of the field work, the IMMP Subcommittee will meet for planning the next stages of the project and discussion regarding the final report for the IMMP pilot project.**

Brief Technical Advisory Committee (TAC) Update

The BOF's TAC, formed to oversee a scientific literature review of studies pertinent to riparian buffers and functions, last met on June 12th to finish work on Scope of Work primers, key questions, and suggested references for five riparian function areas (heat, sediment, wood, nutrients, and water). The CAL FIRE contracts office has posted a Request for Proposal (RFP) since July 16th (DGS website). The deadline for proposals is August 13th. **On August 21st, there will be a TAC evaluation team meeting (not a public meeting) to select a contractor for the project.**

New and Unfinished Business

Mike Gaedeke provided a very brief update on the Little Creek watershed study, located on Cal Poly San Luis Obispo's Swanton Pacific Ranch in Santa Cruz County. This is an MSG cooperative watershed project that has been ongoing since 2001. Pre-harvest calibration for the paired and nested watershed study is documented in Mr. Gaedeke's Masters thesis (posted on the MSG website at: http://www.bof.fire.ca.gov/PDFS/Gaedeke_Thesis.pdf). Five new flumes have been recently installed in Class II and III watercourses to document sediment delivery from small headwater tributaries. **A NTMP is currently being written and logging treatments are scheduled to begin next summer.**

George Gentry stated that the BOF's Strategic Plan calls for a committee on research to be developed. This committee is to write a report due this year documenting forestry-related research needs for California. **Board Member Doug Piirto and George Gentry will develop an outline for the report and develop a list of potential committee members. They will send out requests for assistance and/or information. Additionally, Mr. Gentry will post the last report written by the BOF documenting research needs written in 2003.**

Public Comment

Richard Gienger stated that the newly approved Coho Salmon Incidental Take Assistance rule package includes language requiring monitoring (the rule package is posted at: http://www.bof.fire.ca.gov/pdfs/2112reg050107revised_5_1.pdf). **He suggested that the MSG consider how this should occur with agenda item(s) at future meetings and/or development of a new MSG subcommittee.** Mr. Gentry agreed that this would be worth considering.

Next MSG Meeting

The next MSG meeting date is set for September 5th and 6th in Fresno. This will be an office and field meeting to discuss and observe the Kings River Experimental Watershed (KREW) study being conducted by the USFS-PSW. Dr. Carolyn Hunsaker invited the MSG to see her extensive project in the southern Sierra Nevada. The plan is to meet for approximately three hours the afternoon of September 5th indoors and tour the Teakettle Experimental Forest on September 6th. When an exact agenda is available, it will be emailed to the group. Detailed information on the project is available at: http://www.fs.fed.us/psw/programs/snrc/water/kingsriver/.